RFID FOR FOOD INVENTORY

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By

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CERTIFICATION OF APPROVAL

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Farhana binti Abdul Hadi

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TRONOH, PERAK

June 2009

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

FARHANA ABDUL HADI

ABSTRACT

The aim of this project is to develop a system for food inventory using Radio Frequency Identification (RFID) as the identification. The system is a wireless communication technology that is used to uniquely identify tagged foods in food inventory at home. The system is an integrated system of Radio Frequency Identification components which are the tag, the interrogator and the controller. The tag that will be used in the system is the passive tag. The frequency that will be used in the system is Low Frequency (LF) range. The interface of the controller will be designed by using the Microsoft Visual Studio 2005. Microsoft SQL will be the media to store the database of the food stored. The user only need to key in the data of each food once and the system will memorize it. The system will identify the status of the stored food base on the database stored and notify the user each time the food being used. A warning window will appear to notify the user if the status of the food is below the determined specification.

ACKNOWLEDGEMENTS

Firstly, I would like to thank the Almighty God for giving me the strength and time to complete this project.

To my father and my family, thank you for your love and support while I am facing the hardship in the project.

I also would like to give my most gratitude to my supervisor, Dr Hasnah Mohd. Zaid for giving me support and was always understanding despite all the errors and delays that I made during the completion of the project.

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INTRODUCTION

1.1. Background Of Study

Consumers purchase a variety of goods that become unusable after prolonged storage. Some of these goods such as dairy items, vegetables, and meats are stored in a refrigerator to prolong the storage life of the item. However, once the item is stored either in cooked or leftover form, or uncooked form, a consumer may forget about the item for too long a period. Then, when the consumer remembers the item, the consumer may discover that the item is no longer suitable for use. This is wasteful and leads to consumer dissatisfaction. By having a system that manage to identify and alert them the expiry date, the quantity, the type of food, the date of bought, and the other data, this would be a great help for the consumer.

The system should be able to automatically monitor the types and quantities of food items that stored in the inventory at any given time, can alert consumer when the inventory of a particular item is nearing exhaustion and that more of such items should be purchased, and can alert personnel when food items in the inventory must be discarded. It would be desirable for the system to manage food items in the inventory so that they are utilized on a first-in, first out basis, and to manage the food no matter what time the food is taken out.

In this project, the benefit of Radio-Frequency Identification (RFID) technology in food tracking system will be used. This technology has been proved to be the solution

for healthcare, manufacturing, asset management systems and many more. UTP's Information Resource Centre (IRC) is also using RFID Solution for their book tracking.

1.2. Problem Statement

1.2.1. Problem Identification

Poor food management can result in a higher potential for parasitic or bacterial contaminant to develops, or even for food poisoning to occur. These problems usually occur due to:-

- The consumer forgot when the expiry date of the food is.
- The consumer did not aware of the quantity of food that had been bought
- The consumer lost track of the type of food that available in the inventory and proceeded with the purchase of a new one

1.2.2. Significant Of Project

This project will come out with an efficient and applicable system for identifying the food data in the inventory. By conducting this project, the problem with wasted food in household could be prevented. The food inventory will become more manageable and the food information is traceable.

1.3. Objective And Scope Of Study

1.3.1. Objective Of This Project

To develop systems that will keep track the status of food inventory by using RFID tag and reader.

1.3.2. Scope of Project

To construct an applicable and user friendly Graphical User Interface (GUI) as the interface for the RFID tags and reader using Microsoft Visual Basic 2005 to retrieve the data needed from the food inventory. The project is also to develop a database to store the data of the food stored in the food inventory.

CHAPTER 2

LITERATURE REVIEW

2.1 Background of Radio-Frequency Identification (RFID)

A barcode is a representation of information in dark ink in a light background that creates high and low reflectance (shown in Figure 1). The high and low reflectance can be read by a machine called barcode reader, which is converted to 1s and 0s. Universal Product Code (UPC) barcode labels are the best-known and most widespread use of barcodes that has been on millions of consumer products.

Figure 1: Barcode example

Barcodes cannot satisfy the sophisticated requirements in today's supply chain management systems. They have several shortcomings like

1) need line-of-sight detection
2) can store limited information in the code
3) the barcodes cannot be reprogrammed
4) if label is ripped or soiled or fallen off, there will be no way to scan the item
5) The standard barcodes only identify the manufacturer and product, but not the unique item.

Therefore, Radio Frequency Identification (RFID) was introduced to overcome those shortcomings of the barcodes system. RFID allow contactless identification of objects using Radio Frequency. Some of the advantages of RFID are:-

1) The ability to scan and identify each merchandise in a full shopping cart without removing individual items.
2) The ability to relocate product that is lost or misplaced in a warehouse
3) Capable of tracking a person or a vehicle location inside a building when the Global Positioning System (GPS) signals cannot be received
4) Tag information can be read from up to 30-feet away, without having to scan anything with a laser, the way that barcodes scanner is required to do now. [1]

2.1 Concept Of RFID

2.1.1 Introduction to RFID

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader. Passive RFID tags have no internal power supply while active RFID tags have their own internal power source, which is used to power the integrated circuits and broadcast the signal to the reader. [2]

RFID labels and readers can be operated at several frequency ranges. These ranges of frequency are meant for specific application characteristics. For short-range application such as antitheft systems in automobiles, low frequency devices 30 to 300 kHz) are used. For the common applications such as smart

card and smart label used for baggage tracking, a high frequency devices (3 to 30 MHz) is used. Normally, those systems operate at 13.56MHz. [3]

In any RFID system, there are three basic components, which are the RFID Reader, the RFID Tag and the Host Computer. These components will be explained in the following sections.

2.1.2 RFID Reader

An RFID reader is composed of an antenna, a Radio Frequency electronics module, and a controller electronics module. The RF electronics module is responsible for communication with the RFID tags, while the controller electronics module is responsible for communicating with the host computer. The functions of the reader are to stimulate tags, read data from the tags and transmit it via a network to the host computer.

There are many forms of RFID reader, as we can see from the figure 2 below. They can be in the form of a stationary reader (desktop reader), portable reader, embedded reader module and many more.

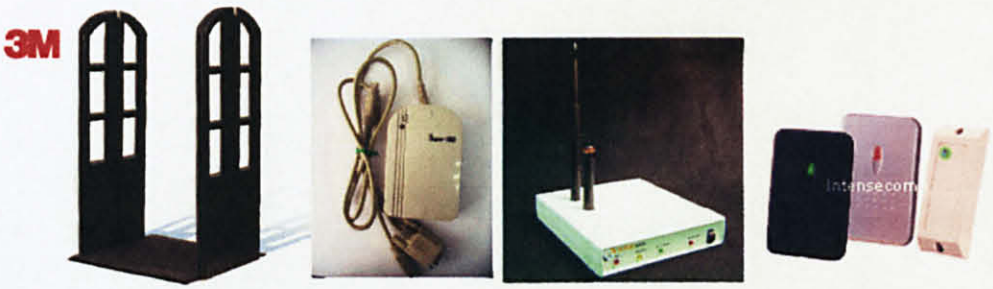

Figure 2 : Various forms of RFID reader

2.1.3 RFID Tag

The RFID tag contains tiny semiconductor chips, miniaturized antennas and sometimes a battery. The tag can be in many forms, such as paper labels, cards, wristband as shown in Figure 3. They have to be in many forms that suit their application. These tags are to be attached to a person, objects or asset that the users want to track. [3]

Figure 3 : Various form of RFID tags

The various forms of RFID tags can be divided into two types, which are the Active and Passive RFID Tags.

a) Passive Tags

Passive tags obtain energy during transmission from the reader. They do not have any internal power source; therefore they rely completely on the signals generated by readers. The advantages of passive tags are

1. They are less expensive
2. The tags are smaller and thinner, very suitable for the application like tracking documents or books in libraries.
3. Extended useful life since they do not depend on battery. [4]

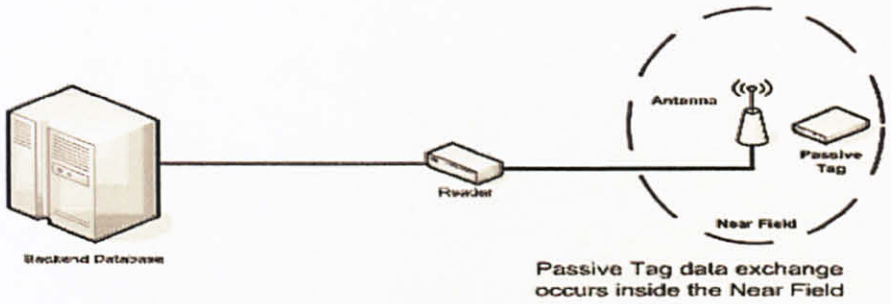

Figure 4 : Passive tags topology [4]

b) Active Tags

Active tags use on-board batteries to power communications, a processor, memory, and possibly sensors [4]. Active tags can be read from up to 100 feet away, thus they are suitable for the purpose of toll road collection and tracking hospital equipment, railcars and other valuable assets. Due to the presence of the battery, they are bulky and expensive and unsuitable for use on library or retail items. The active tags topology is as shown in Figure 5.

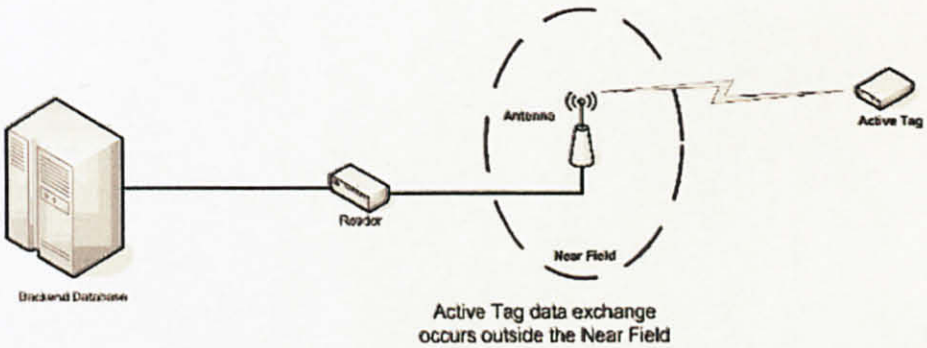

Figure 5 : Active tags topology [4]

There is a data storage capability in the tiny semiconductors that resides in the RFID tag. There are four main in characteristics regarding the data storage capability in RFID tag. They are:-

1) Data capacity
2) Read/write characteristics
3) Passwords and encryption
4) RTF versus TTF

The characteristics are discussed as follows: -

1) Data capacity – the data capacity in RFID tags nowadays are getting better. A library tags for example, typically have space for 256 bits of information, which is more than adequate for current system demands. Some tags have room for up to 2,048 bits of information. This is one of the advantages in RFID system that overcomes the lack of information that can be stored in traditional barcode system.
2) Read/write characteristics – with the read write capability in RFID tag, the information stored in it can be corrected and updated when necessary. However, not all type of tags has this feature.
3) Passwords/encryption: with the capability of holding information, the data in the RFID tags are encrypted to provide additional privacy to the user. Only the RFID readers that have the encryption code can read the data from the encrypted tag.
4) RTF versus TTF – All RFID readers transmit constant signal that can power up the RFID tags that are within range. In a system where the 'reader talks first' (RTF), the reader will transmit a second command signal that request the data from the tags. Consequently, the tags response to the second signal from the reader, and start transmitting identifier and pertinent data it stores to the reader. While in the 'tag talk first' (TTF) environment, the tags immediately response to the reader's power up signal, without requiring the reader to send second command signal as in RTF. Most of RFID system implemented out there are RTF system.[5]

2.1.4 *Host Computer*

The host computer is very important in any RFID system. The host computer can take the shape of a personal computer, laptop, server or a workstation as long as they run database and control software. The host computer is like the brain of the RFID system. Information collected from the tags is processed by the host. [1]

2.1.5 *Operating Frequencies*

The operating frequency is the electromagnetic frequency the tag uses to communicate or to obtain power[6]. RFID typically operates:

- Low frequency (LF) ,
- High frequency (HF),
- Ultra-high frequency (UHF)

Table 1: Operating frequencies in RFID [6]

Frequency Band	**Description**	**Operating Range**	**Applications**
125KHz to 134 KHz	Low Frequency	< .5M or 1.5ft.	• Access Control • Animal Tracking • Vehicle immobilizers • Product Authentication • POS applications
13.56 MHz	High Frequency	< 1M or 3ft.	• Smart Cards • Smart shelve tags for item level tracking • Library Books • Airline Baggage • Maintenance data logging
860 MHz to 930MHz	Ultrahigh Frequency (UHF)	3m or 9ft.	• Pallet tracking • Carton Tracking • Electronic toll collection • Parking lot access

2.1.6 Principle Of Work

All RFID systems have two basic ways of exchanging information:

(1) Inductive coupling or

(2) Electromagnetic backscatter

2.1.6.1 Inductive Coupling

Inductive coupling means that the tag and the reader's antenna are coupled by the magnetic flux through both coils. All the energy used in the tag comes from the primary coil of the reader's antenna. Figure 6 show the inductive coupling in RFID system.

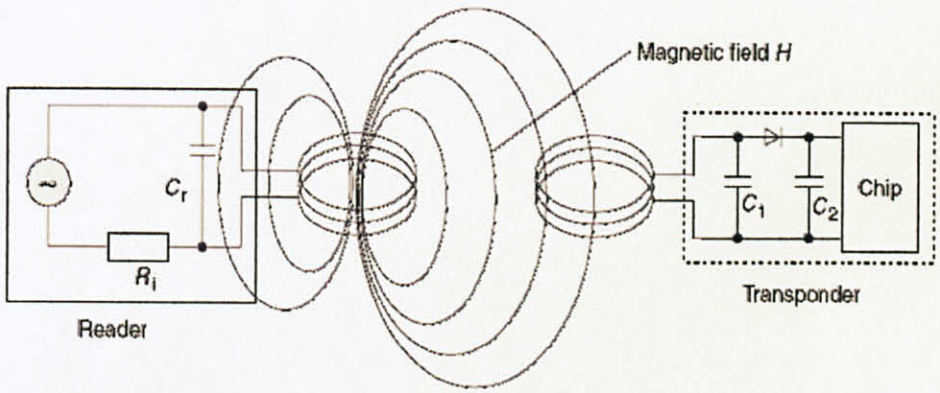

Figure 6 : Inductive coupling in RFID system [7]

2.1.6.2 Electromagnetic Backscatter

Electromagnetic backscatter is quite similar to radars. Depending on its characteristics, an antenna reflects part of an incoming electromagnetic wave back to the sender. Electromagnetic waves are reflected by most objects that are larger than half the wavelength. The efficiency of reflection is particularly large for antennas that are in resonance with the incoming waves. The short

wavelengths of UHF facilitate the construction of antennas with smaller dimensions and greater efficiency.

The power reflected from the transponder is radiated into free space. A small proportion of this (free space attenuation) is picked up by the reader's antenna. The reflected signal travels into the antenna connection of the reader in the backwards direction and can be decoupled using a directional coupler. [7]

2.2 RFID Characteristics

One of the characteristics of RFID that has made it suitable for tracking systems is traceability. Traceability is becoming a method of providing safer food supplies and of connecting producers and consumers. The information concerning the items is stored in the database at the origin and may be used upstream in the supply chain (e.g., in the ordering process to define the requirements of an ordered product), or downstream (e.g., in delivery processes to specify the characteristics of products). Additionally, the information can be used for reporting purposes, either in the supply chain or for third parties.[8] Radio waves exhibit different characteristic at different frequencies. These characteristic should be taken into account in the design of an RFID solution. For RFID solutions, there are three main characteristic to keep in mind: 1. Data rate, 2. permittivity, and 3. Distance.[9] The combination of UIC (unique identification code), user data, and serial number and on board memory makes it possible to track, recall, or document the life span of a single item without any human intervention.[10]

2.3 RFID Applications

One of the companies that have widely used the RFID technology is Mark & Spencer (M&S). In the initial trial, which was partially funded by the U.K.'s Department of Trade and Industry as part of the New Wave Technology program, M&S tagged 10,000 items of men's suits, shirts and ties between Oct. 13 and Nov. 7 and sold 7,000 of the tagged items during that period.[11] Another RFID project was trialed at a Taiwanese hospital in conjunction with a national effort to combat Severe Acute Respiratory Syndrome (SARS). The project demonstrated the feasibility of RFID in hospitals but also highlighted not only technical difficulties but also both the difficulty of persuading medical professionals to accept and use the system.[12] Universiti Terbuka Malaysia (UNITEM) has implemented the The RFID-based library system. The system uses a flexible, paper-thin tag from TAGSYS, a leading manufacturer of complete radio frequency systems, containing a silicon chip affixed directly to a library book (or CD) and read with an RFID scanner. The tag enables both item identification and anti-theft at the same time, thus revolutionizing traditional security systems. Line of sight is not essential for reading the tags with the scanner; therefore, books require much less human handling to be processed. VTLS provides custom software and integrates the reader hardware with the library's existing circulation software for a seamless system.[13] With the ability of the RFID system, it is planned that the project can come out with an improve food inventory system. It is recommended to use PhidgetRFID as it is easy a set of "plug and play" building blocks for low cost USB sensing and control from the Personal Computer. It also assists the user to develop the coding for the Microsoft Visual Basic software.[14]

2.4 Problems With Food Management

Diners are conscious of food safety, as are food operators. Poor food management can result in a higher potential for parasitic or bacterial contaminants to develop, or even for food poisoning to occur.[15] Food is mostly store in an inventory. However, it has been discovered that by using inventory few problems had occurs.

Inventory record inaccuracy, i.e. the discrepancy between the recorded inventory and the actual inventory physically present on the shelf, may therefore be a substantial problem in retail environments.[16]

CHAPTER 3
METHODOLOGY

3.1 Procedure Identification

There are some procedures to be followed in order to carry out and implement the project. This is to ensure that the project can be accomplished within the given timeframe.

First of all, literature review and analysis were conducted. This includes the study of RFID technology as well as the study of the problem in the current food management that available in the market. After that, hardware study and analysis was done. In hardware study, an internet search was done as much as possible for the RFID devices that are available on the market. The strength and weaknesses of each device were analyzed in order to select the most feasible device for the project.

Next, is a quite time consuming part of the project, which is SQL and VB.NET self learning part. While still learning the SQL and VB.NET programming, the project code was developed. Next, is the crucial part of the project, where the hardware and database were integrated until the system run accordingly. This part requires error debugging and system modification when error encountered.

After the crucial part settle down, the user interface have to be improved. The procedure can be summarizing as the flow chart below.

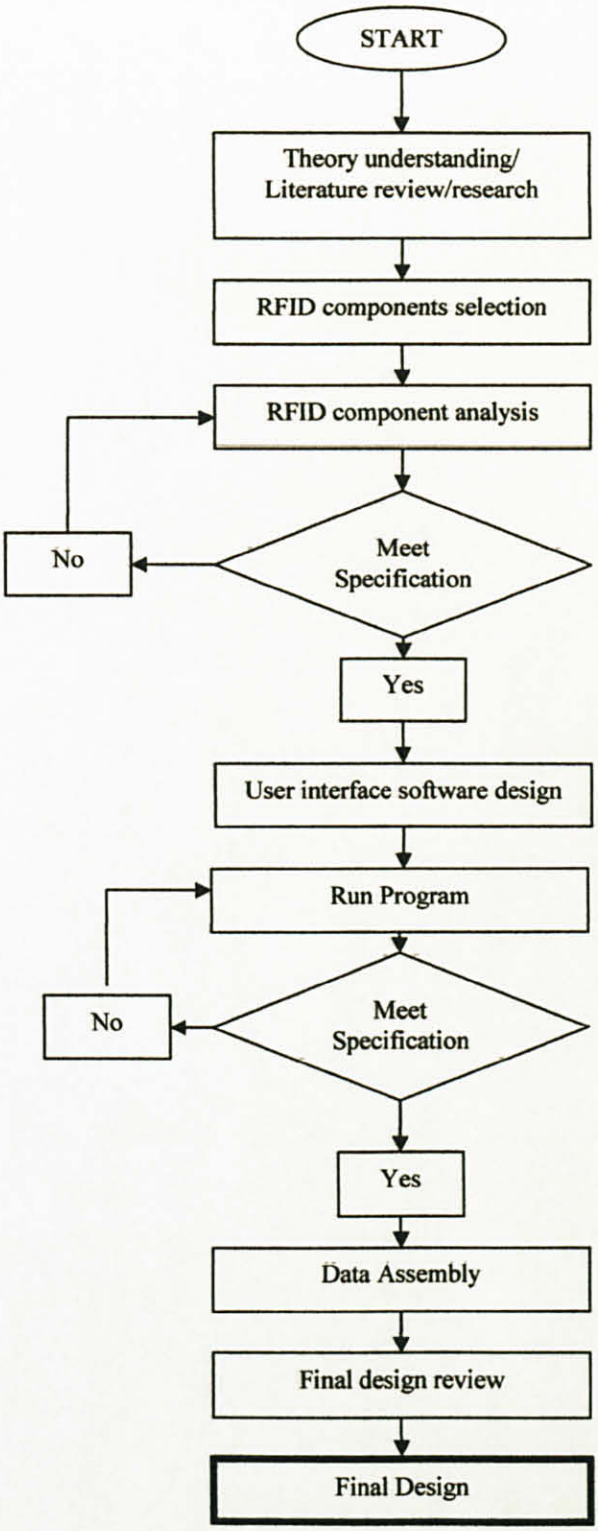

Figure 7: Flow of project methodology

Table 2: The Project Timeline

		2008/2009											
No	Task	J	A	S	O	N	D	J	F	M	A	M	J
1	Literature Review And Analysis												
2	Hardware Study And Analysis												
3	SQL and VB.NET Self Learning												
4	Develop The Project Codes												
5	Integrate Hardware with The Database												
6	Error Debugging and Modification												
7	Improve User Interface												

Table 2 show the project timeline which total up 12 months of the project duration.

3.2 Tools and Equipment Required

3.2.1 Hardware

The three components of an RFID system

- Passive and "smart "tags
- Interrogator
- Controller

The desired frequency for the RFID system is the Low Frequency (LF). The frequency has a read range of around one feet and suitable for the project. The tag power source is generally passive. The LF RFID is very affordable to be implemented in the household. The disadvantages of using Low Frequency RFID system is that the data rate is that the data stored is small and it has very limited read range.

For the project, the RFID device that has been ordered is PhidgetRFIDs. The device is manufactured by a company from Canada. To obtain the device, an order needs to be done. The order been made via Mr. Kumar Ramasamy from

Trix Technologies, Penang. He will be in charge in receiving the device and hand it to the student by hand.

The PhidgetsRFID Kit has been chosen because the tags can be read when brought to the reader within 3 inches of the reader. The kit also returns the unique number contained in the tag. This feature is very crucial for the project as a unique number is needed to differentiate each type of food.

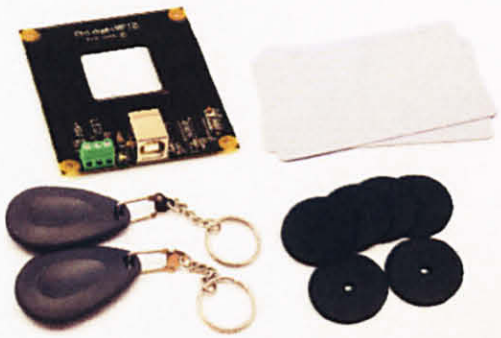

Figure 8: Items available in PhidgetRFID Kit

The packaged comes with:-

- 1023 - PhidgetRFID
- 6 30mm disc RFID Tags
- Credit card sized RFID Tags
- Keyfob RFID Tags
- 180cm USB cable
- Getting Started Manual
- mounting hardware kit
- sheet of labels

The specifications of the device are as below:-

- Reading passive RFID tag
- Operating frequency of 125 kHz
- USB interface and also power source
- Application Programming Interfaces (APIs) include VB6, VB.NET, C#.NET, C++, Flash 9, Flex, Java, LabVIEW, Phyton, Max/MSP and Cocoa.
- Suitable with operating system Windows 2000/XP/Vista, Windows CE, Linux and Mac OS X.
- Using EM4102 protocol, and require the RFID tag with the same protocol to work with.[17]

The kit cost is $90.00 CAD or approximately RM290.00. The shipping delivery costs about RM 260.00. The total cost of this kit is RM 550.00.

3.2.2 Software

- Visual Basic 2005 (VB 8.0)

Visual Basic is a platform for the programmer to design their own designated software. It was designed to be easy to learn and use. The language not only allows programmers to create simple GUI applications, but can also develop complex applications as well. Programming in VB is a combination of visually arranging components or controls on a form, specifying attributes and actions of those components, and writing additional lines of code for more functionality. Since default attributes and actions are defined for the components, a simple program can be created without the programmer having to write many lines of code. Performance problems were experienced by earlier

versions, but with faster computers and native code compilation this has become less of an issue.

Visual Basic uses the drag and drop techniques in creating the forms. A toolbox is available to place controls such as text boxes, button and label on the form window. Default values are provided when the control is created, but may be changed by the programmer. Many attribute values can be modified during run time based on user actions or changes in the environment, providing a dynamic application. For example, code can be inserted into the form resize event handler to reposition a control so that it remains centered on the form, expands to fill up the form, etc. By inserting code into the event handler for a key press in a text box, the program can automatically translate the case of the text being entered, or even prevent certain characters from being inserted.

The language has a large library of utility objects, and has basic object oriented support. Since the more common components are included in the default project template, the programmer seldom needs to specify additional libraries. Unlike many other programming languages, Visual Basic is generally not case sensitive, although it will transform keywords into a standard case configuration and force the case of variable names to conform to the case of the entry within the symbol table entry. String comparisons are case sensitive by default, but can be made case insensitive if so desired.

3.3 Project Activities

The project activity consists of

1) Learn basic connection between VB.NET and SQL Server database to insert, delete and retrieve data in SQL database from VB.NET
   -Learn mostly from books in library and tutorials in the internet, such as [18] and[19].
2) Develop the coding for the program

3) Improving the program from time to time

Figure 9 shows the flowchart of the system development.

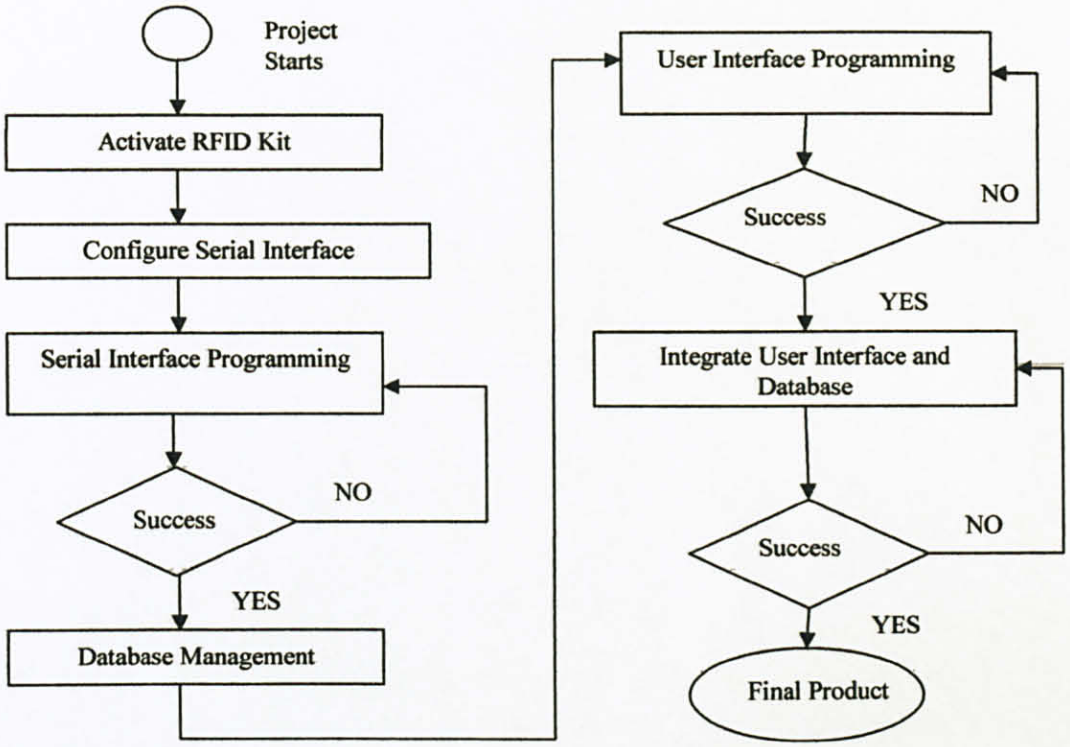

Figure 9 : Flowchart of the RFID for Food Inventory Development

In the RFID Tracking System Development, there are several steps that were taken. First of all, the serial interface programming has to be checked that it is working. In serial interface programming a code in VB.NET was developed to control the RFID device through USB port.

Then, the SQL database was managed through VB.NET codes. This involves insertion, deletion, updating, and retrieving data from the database. Followed by displaying the necessary information in VB.NET user interface.

Finally, the user interface and database were integrated and checked that the program run smoothly.

CHAPTER 4
RESULT AND DISCUSSION

4.1 Results on Microsoft Visual Basic

Graphical user interface was designed in order to guide users in using the prototype. The GUIs were developed using Microsoft Visual Basic 8 where it was connected with two elements:

a) Microsoft SQL: - Stores the database of product information which includes the tag code, product name, manufacturer details and other related data to the food.
b) Reader: - Reader acts as an interface between the software program installed in the hosting computer and tag attached to the items.

4.1.1 Log in Form

Figure 10 : Food Inventory Tracking System Login Menu

Figure 10 shows the login page for the user interface. User can log in as Store Manager (using password) or Consumer.

Store Manager is the person who is in charge in make sure all the food are tagged and register to the database. The Store Manager will be assisted by the Store Assistant to do the job.

The Consumer is the user who bought the food from the retail outlets. They then stored the food into their inventory. They are the people who need to track their food status in order to make their life easier.

4.2.2 Store Manager Login Page

When the person is login as the Store Manager, figure 11 will come to view.

Figure 11: The Store Manager Login Page

The user needs to enter their username and password before hitting in the login button to log in to the program. The user will not proceed to the next step if either one of the username or password is key in wrongly. The password is for security purpose.

This is to ensure only authorize person is allowed to enter data registering and tagging page.

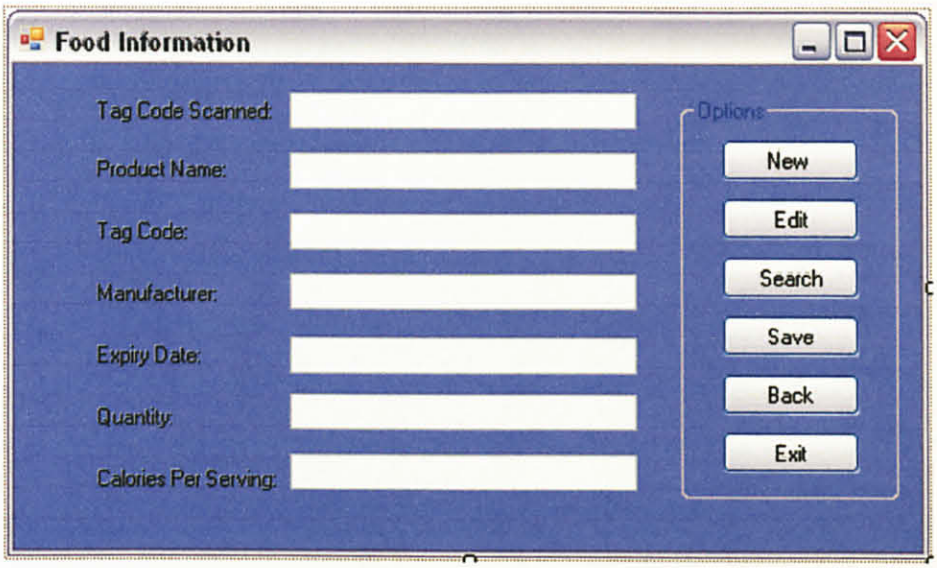

Figure 12 : Food Information Registration Page

When the login has been successful, the page that is going to be displayed is as in figure 12. This is the food registration page. This page is the where all the data of the food will be attached to the tag. The data entering can be done either by the Store Manager or the Store Assistant. When the 'save' button is hit, all the data entered is attached to the respective tad code. If there is some modification to any of the data, the store assistant can always use the edit button to edit the data entered.

The connection between the communication port and the reader happens here. At this time, the RFID reader is activated and waiting the user to tag the food to it. When the tag is detected, the Store Assistant can fill in the required data. When the form is done, they can click the 'Save' button and all the data are save into the database. In case the user tag or enter wrong food description, he or she can use the 'Edit' button to correct the information.

4.2.3 *Consumer Display Page*

Figure 13 : Consumer views for tracking the food

When the user login as the Consumer, the page will be displayed is as in Figure 13. The page will show whether the RFID reader is attached or not at the 'Status' box. If the RFID reader is connected, the box will display 'Connected' and if not, it will display 'Not connected'. The serial number of the RFID reader will also be displayed when it is connected.

Whenever the RFID reader reads a tag, the data that is attached to the tag will be displayed in the white column. The user also can search for any foods that are already stored in the database by clicking the 'Search' button by key in the tag code. The 'Search' prompt window as in figure 14.

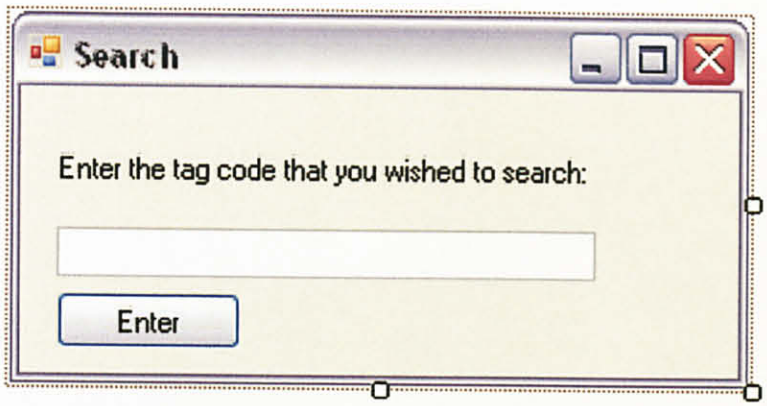

Figure 14 : Search prompt window

When the user wishes to quit the system, another prompt window will appear. The prompt window will ask the user whether they are really sure to exit the application. Once the user has log out the system, they need to key in their username and password in order to access the system again.

The design process flow can be summarizing as figure below:-

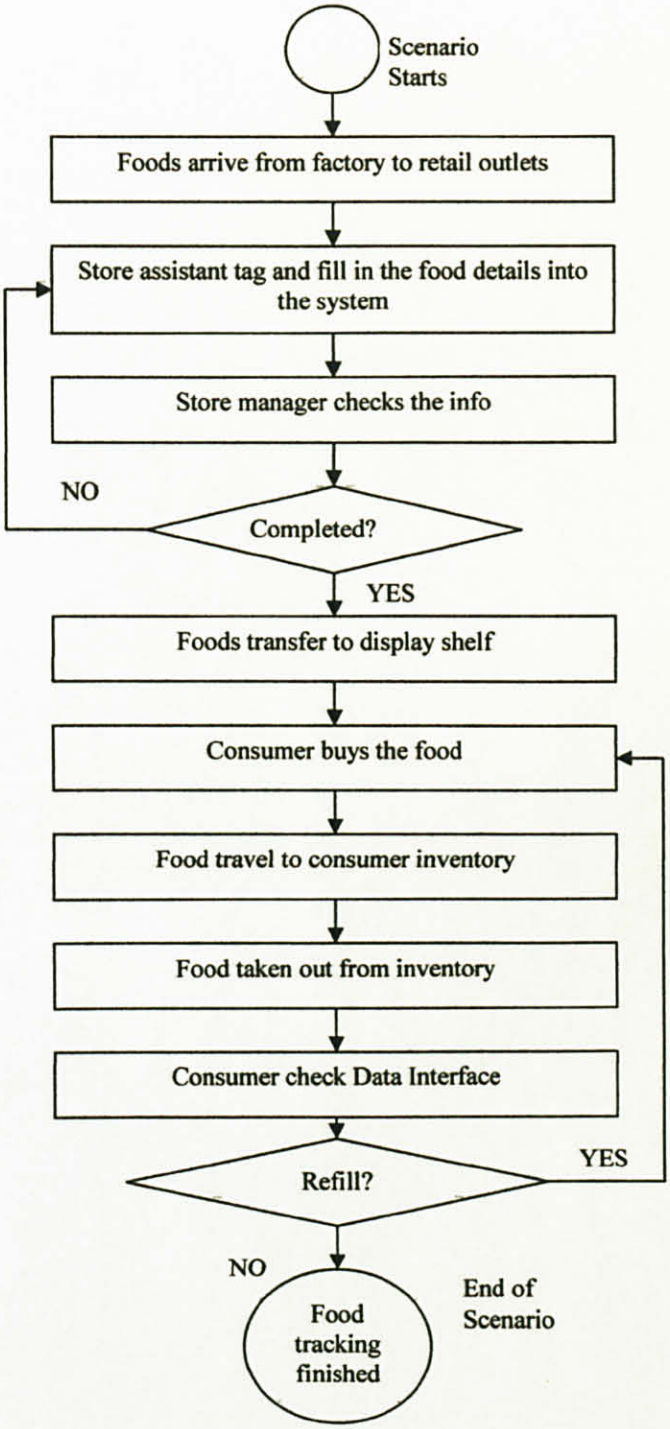

Figure 15 : Design Process Flow

4.2 Discussion

There were some challenges encountered during the development of the projects. One of the challenges is that RFID system does not work well in metal and liquid environment. In metal environment, the radio wave is reflected, while in liquids such as a water environment, they're absorbed. However, the RFID developer has developed a tag that can work well in both environments. The tag is affordable and should be able to overcome this problem.

In the hardware part, the alarm for the system has been added by using a buzzer. However, there is some problem with the programming part in order for the buzzer to function as an alarm.

As for the programming part, a few problems have been encountered such as the system is corrupted. In order to overcome this, a backup file will be constructed each time an update been done to the system. There is an error window will appear when there is an error during the debugging. The system will only be successfully debugged after the error is fixed. Until this point, the system needs a lot more improvement to be done.

CHAPTER 5
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The objective of this project is to develop systems that will keep track the status of food inventory by using RFID tag and reader. The system should be able to display the status of the food such as the product name, manufacturer, the expiry date and the calories. The system is also able to notify the user when the food is nearly exhaustion. The objective of the project has been achieved as the working prototype that can demonstrate the tracking process of the system has been developed. The project has completed within the time frame. As a conclusion, this project will ultimately reduce the food wastage and the food inventory will become more manageable.

5.2 Recommendation

The system can be developed with a longer distance of readability of the reader. As this is the prototype, therefore the readability of the reader is very short. The system also can be expanded where the food nutrition for user's intake can be calculated. Whenever the food nutrition's for ones has reached the limit, a reminder should appear for the user. By adding these features, this system can be an electronic health monitor at everyone's home. The system also can be added with SMS application where the user will be notified for any food shortage via the SMS.

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APPENDIX

Login Form

```
Public Class Frm00Login


    Private Sub btnAdmin_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles btnAdmin.Click
        Me.Hide()
        Frm011Paswd.Show()
    End Sub

    Private Sub btnUser_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles btnUser.Click
        Me.Hide()
        frm04FoodInfo.Show()

    End Sub
End Class
```

Store Manager Login Form

```
Public Class Frm011Paswd

    Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click
        If txtPasswd.Text = "sysadmin" Then
            Frm01Register.Show()
            Me.Close()
            'frmMainMenu.Hide()
            'While UsersTableAdapter.Fill(FypDBDataSet.Users) = 0 ' Loading
Users DataSet. Is it empty?
            ' MsgBox("Please create an initial user, for administrative
purposes.")
            ' formUsers.ShowDialog() ' Open Users Form
            ' Me.Hide()
            'End While
        Else
            MsgBox("Sorry, you are not the authorize person to modify user
account. Please try again." & vbNewLine & "Please enter the password one
more time.", MsgBoxStyle.Exclamation)
            'Me.DialogResult = Windows.Forms.DialogResult.No
        End If
    End Sub

End Class
```

Food Registration Form

```
Imports System.Data.SqlClient

Public Class Frm01Register

    Dim WithEvents phidgetRFID As Phidgets.RFID
    Dim dates As Date
    Dim dtabledoc2 As DataTable

    Private Sub Frm01Register_Load(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles MyBase.Load
        phidgetRFID = New Phidgets.RFID

        phidgetRFID.open()
    End Sub


    Private Sub phidgetRFID_Attach(ByVal sender As Object, ByVal e As
Phidgets.Events.AttachEventArgs) Handles phidgetRFID.Attach


        phidgetRFID.Antenna = True

    End Sub

    Private Sub phidgetRFID_Detach(ByVal sender As Object, ByVal e As
Phidgets.Events.DetachEventArgs) Handles phidgetRFID.Detach
        'If the Phidget RFID detaches close the form
        Me.Close()

    End Sub

    Private Sub frm04FoodInfo_FormClosing(ByVal sender As Object, ByVal e
As System.Windows.Forms.FormClosingEventArgs) Handles Me.FormClosing
        'If the form closes and the Phidget RFID is attached Close it.
        If phidgetRFID.Attached = True Then
            phidgetRFID.close()
        End If
    End Sub

    Private Sub phidgetRFID_Error(ByVal sender As Object, ByVal e As
Phidgets.Events.ErrorEventArgs) Handles phidgetRFID.Error
        'If the Phidget RFID is not attached when the form opens show
        'message box and close the form
        MessageBox.Show(e.Description)
        Me.Close()
    End Sub

    Private Sub phidgetRFID_RFIDTag(ByVal sender As Object, ByVal e As
Phidgets.Events.TagEventArgs) Handles phidgetRFID.Tag

        If e.Tag <> "" Then


            txtTagId.Text = e.Tag
            'dates = Date.Now
            'txtdate.Text = dates
        End If

    End Sub
```

```
    Private Sub phidgetRFID_TagLost(ByVal sender As Object, ByVal e As
Phidgets.Events.TagEventArgs) Handles phidgetRFID.TagLost

        txtTagId.Text = ""

    End Sub



    Private Sub BtnSave_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles BtnSave.Click
        Dim strConnection As String = "Data Source=.\SQLEXPRESS;Initial
Catalog=Tag id;Integrated Security =True"
        Dim conn As SqlConnection

        conn = New SqlConnection(strConnection)
        conn.Open()
        Dim check1 As Integer
        Dim cmd4 As New SqlCommand
        Dim dAdapterDoc2 As New SqlDataAdapter

        cmd4 = conn.CreateCommand
        'cmd4.CommandText = "INSERT INTO FoodInfo
(TagID,Product_Nme,Manfact,Expiry_d,Qty,Calory,Location) VALUES ('" &
Trim(txtTagId.Text) & "', '" & Trim(txtProductNme.Text) & "', '" &
Trim(txtManFact.Text) & "','" & Trim(txtExpiry.Text) & "','" &
Trim(txtQty.Text) & "','" & Trim(txtCalory.Text) & "','" &
Trim(txtLocation.Text) & "')"
        cmd4.CommandText = "INSERT INTO FoodInfo
(TagID,Product_Nme,Manfact,Expiry_d,Qty,Calory,Location) VALUES ('" &
Trim(txtTagId.Text) & "', '" & Trim(txtProductNme.Text) & "', '" &
Trim(txtManFact.Text) & "','" & Trim(dtpExpiryDate.Value) & "','" &
Trim(txtQty.Text) & "','" & Trim(txtCalory.Text) & "','" &
Trim(txtLocation.Text) & "')"
        'VALUES('" & Trim(cmbPosition.Text) & "','" & Trim(cmbDept.Text) &
"','" & Trim(cmbLocation.Text) & "','" & Trim(txtPhoneOffice.Text) & "','"
& Trim(txtPhonePersonal.Text) & "','" & Trim(txtEmail.Text) & "')
        dAdapterDoc2.SelectCommand = cmd4
        check1 = cmd4.ExecuteReader.RecordsAffected()
        If check1 > 0 Then
            MsgBox("Successfully added to database.", MsgBoxStyle.OkOnly,
"Message:")

        Else
            MsgBox("Failed to be added.", MsgBoxStyle.OkOnly, "Messsage:")

        End If

        conn.Close()
        'Me.Hide()
    End Sub


    Private Sub txtTagId_TextChanged(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles txtTagId.TextChanged

    End Sub

    Private Sub BtnNew_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles BtnNew.Click
```

```
        Dim Frm01Register As New Frm01Register
        Frm01Register.Show()
        Me.Hide()

    End Sub

    Private Sub btnExit_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles btnExit.Click
        Dim Frm00Login As New Frm00Login
        Frm00Login.Show()
        Me.Hide()
    End Sub

    Private Sub BtnSearch_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles BtnSearch.Click
        Me.Hide()
        Frm03Search.Show()
    End Sub
End Class
```

Display Food Data

```
Imports System.Data.SqlClient


Public Class frm04FoodInfo
    Dim WithEvents phidgetRFID As Phidgets.RFID
    Dim dtabledoc2 As DataTable


    Private Sub frm04FoodInfo_Load(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles MyBase.Load

        phidgetRFID = New Phidgets.RFID()
        phidgetRFID.open()

        txtStatus.Text = "Not Connected"

        Dim strConnection As String = "Data Source=.\SQLEXPRESS;Initial
Catalog=Tag id;Integrated Security =True"
        Dim conn As SqlConnection

        conn = New SqlConnection(strConnection)
        conn.Open()

        Dim cmd4 As New SqlCommand
        Dim dAdapterDoc2 As New SqlDataAdapter

        cmd4 = conn.CreateCommand
        cmd4.CommandText = "SELECT * FROM FoodInfo"

        dAdapterDoc2.SelectCommand = cmd4
        dtabledoc2 = New DataTable
        dAdapterDoc2.Fill(dtabledoc2)

        conn.Close()

        DataGridView1.DataSource = dtabledoc2
```

```
    End Sub

    Public Sub New()

        InitializeComponent()

        lvPhidgetInfo.MultiColumn = False
        lvPhidgetInfo.Items.Insert(0, "NO" & "     " & "PRODUCT NAME" & "
" & "MANUFACTURER" & "      " & "EXPIRY DATE" & "     " & "QUANTITY" & "
" & "CALORIES" & "      " & "LOCATION")


    End Sub

    Private Sub phidgetRFID_Attach(ByVal sender As Object, ByVal e As
Phidgets.Events.AttachEventArgs) Handles phidgetRFID.Attach

        txtStatus.Text = "Connected"
        txtNumOutputs.Text = phidgetRFID.outputs.Count
        txtSerialNumber.Text = (Str(phidgetRFID.SerialNumber))
        phidgetRFID.Antenna = True
        CheckBox3.Checked = True
        phidgetRFID.LED = False
        CheckBox2.Checked = True
        CheckBox0.Checked = False


    End Sub
    Private Sub phidgetRFID_Detach(ByVal sender As Object, ByVal e As
Phidgets.Events.DetachEventArgs) Handles phidgetRFID.Detach
        'If the Phidget RFID detaches close the form
        Me.Close()

    End Sub

    Private Sub frm04FoodInfo_FormClosing(ByVal sender As Object, ByVal e
As System.Windows.Forms.FormClosingEventArgs) Handles Me.FormClosing
        'If the form closes and the Phidget RFID is attached Close it.
        If phidgetRFID.Attached = True Then
            phidgetRFID.close()
        End If
    End Sub

    Private Sub phidgetRFID_Error(ByVal sender As Object, ByVal e As
Phidgets.Events.ErrorEventArgs) Handles phidgetRFID.Error
        'If the Phidget RFID is not attached when the form opens show
        'message box and close the form
        MessageBox.Show(e.Description)
        Me.Close()
    End Sub

    Private Sub phidgetRFID_RFIDTag(ByVal sender As Object, ByVal e As
Phidgets.Events.TagEventArgs) Handles phidgetRFID.Tag
        Static count As Integer
        Dim date1 As Date
        date1 = Date.Now
        datte.Text = date1
```

```
        TextBox2.Text = "Not registered"
        car_type.Text = ""
        plateno.Text = ""
        calory.Text = ""
        location.Text = ""


        TextBox1.Text = e.Tag
        count = count + 1



        Dim strConnection As String = "Data Source=.\SQLEXPRESS;Initial
Catalog=Tag id;Integrated Security =True"
        Dim conn As SqlConnection

        conn = New SqlConnection(strConnection)
        conn.Open()
        Dim check1 As Integer
        Dim cmd5 As New SqlCommand
        Dim dAdapterDoc3 As New SqlDataAdapter

        cmd5 = conn.CreateCommand
        cmd5.CommandText = "INSERT INTO FoodInfo
(Product_Nme,Manfact,Expiry_d) VALUES ('" & Trim(TextBox2.Text) & "', '" &
Trim(plateno.Text) & "','" & Trim(datte.Text) & "')"

        dAdapterDoc3.SelectCommand = cmd5
        check1 = cmd5.ExecuteReader.RecordsAffected()

        conn.Close()



        Dim str_buff(7) As String
        str_buff(0) = count
        str_buff(1) = TextBox2.Text
        str_buff(2) = car_type.Text
        str_buff(3) = plateno.Text
        str_buff(4) = color.Text
        str_buff(5) = calory.Text
        str_buff(6) = location.Text
        str_buff(7) = e.Tag
        Dim lvi_buff As New ListViewItem(str_buff)

        ListView1.BeginUpdate()
        CheckBox0.Checked = True
        CheckBox0.Checked = False

        ListView1.Items.Add(lvi_buff)
        ListView1.Refresh()
        ListView1.EndUpdate()

    End Sub

    'This section handles the events for the four checkboxes
    'This is the simplest approach but the least elegant method.
    'It works here because there are only four outputs to handle but can
quickly get out of hand
```

```
    'if there are more outputs to control. Below this section we have added
a commented section
    'that handles all the check boxes in a single sub. Simply comment out
the four subs below and
    'uncomment the sub CheckBox_CheckedChanged
    Private Sub CheckBox0_CheckedChanged(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles CheckBox0.CheckedChanged
        phidgetRFID.outputs(0) = CheckBox0.CheckState
    End Sub
    Private Sub CheckBox1_CheckedChanged(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles CheckBox1.CheckedChanged
        phidgetRFID.outputs(1) = CheckBox1.CheckState
    End Sub
    Private Sub CheckBox2_CheckedChanged(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles CheckBox2.CheckedChanged
        phidgetRFID.LED = CheckBox2.CheckState
    End Sub
    Private Sub CheckBox3_CheckedChanged(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles CheckBox3.CheckedChanged
        phidgetRFID.Antenna = CheckBox3.CheckState
    End Sub
    'This is the slightly more sophisticated approach to handling the
events for all the checkboxes.
    'Private Sub CheckBox_CheckedChanged(ByVal sender As System.Object,
ByVal e As System.EventArgs) Handles _
    'CheckBox0.CheckedChanged, CheckBox3.CheckedChanged,
CheckBox2.CheckedChanged, CheckBox1.CheckedChanged
    '    RFID1.SetOutputState((CType(sender,
System.Windows.Forms.CheckBox).Tag), CType(sender,
System.Windows.Forms.CheckBox).CheckState)
    'Use this if you want to see what's going on:
MessageBox.Show(CType(sender, System.Windows.Forms.CheckBox).Tag.ToString)
    'End Sub


    Private Sub lvPhidgetInfo_SelectedIndexChanged(ByVal sender As
System.Object, ByVal e As System.EventArgs) Handles
lvPhidgetInfo.SelectedIndexChanged

    End Sub

    Private Sub TextBox1_TextChanged(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles TextBox1.TextChanged
        Dim inc1 As Integer = 0
        Dim maxrows1 As Integer

        maxrows1 = dtabledoc2.Rows.Count


        While inc1 < maxrows1

            If TextBox1.Text = dtabledoc2.Rows(inc1).Item(0) Then

                TextBox2.Text = dtabledoc2.Rows(inc1).Item(1)
                car_type.Text = dtabledoc2.Rows(inc1).Item(2)
                plateno.Text = dtabledoc2.Rows(inc1).Item(3)
                color.Text = dtabledoc2.Rows(inc1).Item(4)
                calory.Text = dtabledoc2.Rows(inc1).Item(5)
                location.Text = dtabledoc2.Rows(inc1).Item(6)

                Exit Sub
```

```
            Else
                inc1 = inc1 + 1

            End If
        End While

        If inc1 = maxrows1 Then
            phidgetRFID.Antenna = False
            MsgBox("No data has been entered.", MsgBoxStyle.OkOnly,
"Message:")
            phidgetRFID.Antenna = True
            Exit Sub


        End If


    End Sub

    'Private Sub Button1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles Button1.Click
    '   Form3.Show()
    ' End Sub

    Private Sub TextBox2_TextChanged(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles TextBox2.TextChanged

    End Sub

    Private Sub btnSearch_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles btnSearch.Click
        Try
            ''Frm03Search.Tag =
ListView1.Items(ListView1.SelectedIndices(0)).SubItems(7).Text
            'Frm03Search.Show()
            'Me.Hide()

            Frm05SearchResult.Tag =
ListView1.Items(ListView1.SelectedIndices(0)).SubItems(7).Text
            Frm05SearchResult.Show()
            Me.Hide()

        Catch ex As Exception

        End Try
    End Sub

    Private Sub car_type_TextChanged(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles car_type.TextChanged

    End Sub


    Private Sub Label1_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs)

    End Sub
```

```
    ' Private Sub Studin_but_Click(ByVal sender As System.Object, ByVal e
As System.EventArgs)
    'Try
    '      Stud_info.Tag =
ListView1.Items(ListView1.SelectedIndices(0)).SubItems(7).Text
    '  Stud_info.Show()

    'Catch ex As Exception

    'End Try
    ' End Sub


    'Private Sub ListView1_SelectedIndexChanged(ByVal sender As ListView,
ByVal e As System.EventArgs) Handles ListView1.SelectedIndexChanged

    'End Sub


End Class
```

Search Results

```
Imports System.Data.SqlClient

Public NotInheritable Class Frm05SearchResult
    Dim WithEvents phidgetRFID As Phidgets.RFID
    Dim dtabledoc2 As DataTable
    Private Sub Frm05SearchResult_Load(ByVal sender As System.Object, ByVal
e As System.EventArgs) Handles MyBase.Load

        TextBox9.Text() = Me.Tag


        Dim strConnection As String = "Data Source=.\SQLEXPRESS;Initial
Catalog=Tag id;Integrated Security =True"
        Dim conn As SqlConnection


        conn = New SqlConnection(strConnection)
        conn.Open()

        Dim cmd4 As New SqlCommand
        Dim dAdapterDoc2 As New SqlDataAdapter

        cmd4 = conn.CreateCommand
        cmd4.CommandText = "SELECT * FROM FoodInfo"

        dAdapterDoc2.SelectCommand = cmd4
        dtabledoc2 = New DataTable
        dAdapterDoc2.Fill(dtabledoc2)

        conn.Close()

        DataGridView1.DataSource = dtabledoc2

        Dim inc1 As Integer = 0
        Dim maxrows1 As Integer

        maxrows1 = dtabledoc2.Rows.Count
```

```
        While incl < maxrows1

            If TextBox9.Text = dtabledoc2.Rows(incl).Item(0) Then

                TextBox1.Text = dtabledoc2.Rows(incl).Item(1)
                TextBox2.Text = dtabledoc2.Rows(incl).Item(2)
                TextBox3.Text = dtabledoc2.Rows(incl).Item(3)
                TextBox5.Text = dtabledoc2.Rows(incl).Item(4)
                TextBox6.Text = dtabledoc2.Rows(incl).Item(5)
                TextBox7.Text = dtabledoc2.Rows(incl).Item(6)
                'TextBox8.Text = dtabledoc2.Rows(incl).Item(13)

                Exit Sub



            Else
                incl = incl + 1

            End If
        End While

    End Sub

    Private Sub back_but_Click(ByVal sender As System.Object, ByVal e As
System.EventArgs) Handles back_but.Click
        Dim frm04FoodInfo As New frm04FoodInfo
        frm04FoodInfo.Show()
        Me.Hide()
    End Sub

    Private Sub TextBox9_TextChanged(ByVal sender As System.Object, ByVal e
As System.EventArgs) Handles TextBox9.TextChanged


    End Sub
End Class
```